REMARKS

Administrative Overview

Claims 1, 3-6, 25-27, and 29-32, and 41-43 were pending, following entry of Applicant's fully-responsive Amendment and Response, filed April 12, 2010, and prior to entry of this paper. A telephone interview took place with the Examiner and Applicant's representative on May 11, 2010, regarding this case. The pending claims and cited references were discussed during the interview, and, without acquiescing to the rejections, Applicant's representative agreed to submit this Supplemental Amendment and Response to address technical questions posed by the Examiner during the interview, thereby advancing prosecution of the case.

Applicant amends independent claims 1 and 25, and Applicant adds new dependent claims 44 and 45, as reflected in the Listing of Claims herein. The amendments and new claims are supported in the original specification as filed; no new matter is added. Non-limiting examples of support for the amendments and new claims are presented below.

Applicant amends each of independent claims 1 and 25:

(i) to indicate that the protective media is "for filtering and killing microorganisms in air" -- *see*, for example, original Specification, page 4, lines 16-20 (emphasis added):

> The filter further includes a material that kills on passage vegetative bacteria, spores, and viruses. *They are filtered out of the airstream and are killed.* In addition, the invention is self-sterilizing, meaning that *not only does it filter air* passed there through, *it kills the bacteria* trapped on the filter.

See also, original Specification, page 5, lines 9-10 (emphasis added):

> This innovative media is *capable of eradicating microorganisms* and/or toxins more efficiently than prior art solutions and *can also self-sterilize*.

(ii) to specify that the active agent is "biocidal" – *see*, for example, original Specification, page 9, lines 7-11, an excerpt of which is presented below (emphasis added):

> The *active agent* of the present invention may be, for example, an *antimicrobial* … The *antimicrobial* may be … *biocidal.* … *[A] biocidal is a material that kills* all or some of bacteria, spores, viruses, fungi, etc. Preferably, the biocidal comprises the *iodinated resin* particles …

(iii) to specify that the porous dielectric carrier is capable of holding an electrostatic charge despite the presence of the biocidal active agent (iodinated resin) – *see*, for example, original Specification, page 15, lines 10-11 and 17-18 (emphasis added):

> The substrate *having an active agent incorporated therein* is provided with an electrostatic charge. … The resulting material *holds its charge* for between about 6 months to 2 years.

(iv) to indicate that the biocidal active agent may be incorporated "in or on" the porous dielectric carrier – *see*, for example, original Specification, page 1, lines 19-21, and page 7, lines 1-2 (emphasis added):

> The present invention relates … to an electrostatically charged media with an active agent incorporated *thereon*…

> The present invention provides an electrostatically charged filter media comprising a substrate with an active agent incorporated *therein.*

See also the various methods of incorporating active agent in or on the media, described on pages 12-15 of the original Specification.

Applicants also add new claims 44 and 45, which are supported in the original Specification, for example, at page 15, lines 10-11 and 17-18 (see excerpt above).

Following entry of this paper, claims 1, 3-6, 25-27, 29-32, and 41-45 will be pending.

Interview Summary

Applicant thanks the Examiner for the telephonic interview between Examiner Steele and William Haulbrook, Reg. No. 53,002, representative of Applicant, conducted on May 11, 2010. The following remarks address technical questions posed by the Examiner during the interview.

1. The biocidal air filtration experiments in Exhibit A (BG spores) and Exhibit B (MS2 virus) *both* demonstrate superior performance over use of electret alone (Transweb), and the experimental results in Exhibit A are not at odds with the results in Exhibit B.

The Examiner noted several experimental results in Exhibit A of the original Specification showing BG spore reduction slightly less than 100% for iodinated-resin-containing electret. For one of the two iodinated-resin-containing filtration membranes, results were 99.99924% reduction at 180 minutes, 99.99884% reduction at 300 minutes, and 99.99923% reduction at 360 minutes. For this membrane, a 100% reduction was observed at all other tested times, and for the other resin-containing filtration membrane that was tested, a 100% reduction was observed at all times.

The results for Transweb (electret alone) showed a similar filtration reduction – 100% at all tested times, with slightly below 100% achieved at 30 minutes (99.99471%) and 120 minutes (99.99496%).

Thus, the iodinated-resin-containing electrostatic filter of the present invention achieves essentially the same filtration of BG spores as the Transweb without iodinated resin – both achieve very nearly 100% filtration. *However, the advantage of the iodinated-resin-containing electrostatic filter of the present invention is that it sterilizes (kills) the spores rather than just*

holding the spores in the filter, as is the case with the Transweb. See, for example, page 19, lines 16-21 of the original Specification.

Both the iodinated-resin-containing electrostatic filter and the Transweb without iodinated resin were able to effectively filter the BP spores from the air, but only the iodinated-resin-containing electrostatic filter of the present invention can kill the spores. It is because of the unique ability of the iodinated resin to stabilize (and, in fact, enhance!) the electrostatic charge of the electret that the antibacterial can be used with electret. Therefore, Exhibit A shows that the iodinated-resin-containing electrostatic filter of the present invention achieves a superior performance compared with Transweb electret.

Exhibit B shows experiments in which MS2 virus is filtered from air. These experiments show 100% filtration efficiency for the iodinated-resin-containing electrostatic filter of the present invention. This is greater than the filtration efficiency of the Transweb electrostatic filter without iodinated resin (99.08, 99.02, 99.89, 99.94, 96.45, and 97.48% reductions at various times). Furthermore, the iodinated-resin-containing electrostatic filter of the present invention kills the filtered viruses.

Therefore, Exhibit B shows that the iodinated-resin-containing electrostatic filter of the present invention achieves a superior performance compared with Transweb electret in both filtration efficiency and biocidal performance.

The results of the experiments in Exhibit A and Exhibit B are not at odds. One of the two experiments in Exhibit A had certain readings where % reduction of BG spore filtration was very slightly less than 100% (with the other membrane showing 100% reduction at all readings), but this result is not at odds with the 100% reduction of MS2 virus in Exhibit B. The small deviation from 100% in those particular experiments in Exhibit A are within experimental error. Because perfect, or nearly perfect filtration of both BG spores and MS2 viruses was achieved using the claimed biocidal protective media, and because the iodinated-resin media kills the spores and viruses, the performance of the claimed media is better than electret without iodinated resin (Transweb).

As discussed in Applicant's September 25, 2009 and April 12, 2010, responses, and as discussed in further detail below, the prior art teaches *against* combining an antimicrobial – *particularly an iodine-containing antimicrobial* – with an electret because of a then-believed deterioration in electret performance that would result. Applicant's Declaration, filed on September 25, 2009, demonstrates the surprising result that iodinated resin active agent actually preserved the electrostatic charge of the electret media, thereby maintaining its high filtration efficiency. Not only does the iodinated resin pose no deleterious effect on charge, it is observed that the charge stability is actually *enhanced* by the presence of the iodinated resin, as shown at items #8-10 of the Declaration.

2. Item #4 of Applicant's Declaration, filed September 25, 2009, is supported by the prior art, which teaches against use of anti-microbial agent with electret, and particularly against use of an iodine-containing antimicrobial with an electret.

Item #4 of the above-referenced declaration states as follows (emphasis added):

> I am aware that there have been attempts to combine the beneficial properties of an electrically charged filter media and an antimicrobial filter media prior to the filing of my application. *I am also aware that these attempts have generally met with failure because the antimicrobial agent deteriorates the electric charge and the electric charge diminishes the antimicrobial efficacy of the active agent.*

This statement is fully supported by the prior art. It was believed that the presence of impurities in electrets, *particularly iodine-containing compounds*, was to be avoided, because of the resulting charge decay. For example, U.S. Patent No. 4,086,499 ("the '499 patent") states at col. 1, lines 61-67 as follows (emphasis added):

> As a result of our work, we consider such impurities as residual monomers, alpha-methyl styrene, aromatic solvents, anthracene, and especially polarizable groups *such as iodine*, bromine, etc., as

> well as tetracyanoethylene, tributyl phosphate, and the like, *to be deleterious to the stability of the electrets* made from styrene-type polymer.

Attempts were made to treat electrets with non-iodine containing antimicrobials, in an effort to provide the biocidal properties of antimicrobials with the filtration benefits of electret materials, but unacceptable deterioration of the electret performance was observed. For example, U.S. Patent No. 5,556,618 ("the '618 patent") states at col. 1, lines 50-54 (emphasis added):

> ...[T]he process wherein the formed nonwoven fabric was subjected first to a treatment for imparting an electret property and then to an antibacterial treatment had a drawback that *the antibacterial treatment deteriorated the electret performance* ...

This supports the statement in Applicant's September 25, 2009, Declaration that prior attempts to combine an electrically charged filter media and an antimicrobial generally failed because the antimicrobial agent deteriorates the electric charge.

The '618 patent proposed use of a charge stabilizing compound, along with an inorganic compound as an antibacterial agent (note that iodinated resins were not disclosed). However, the concentration of the antibacterial in the '618 patent still had to be kept low (0.1 to 4% -- *see* Abstract) in order to avoid unacceptable charge deterioration, and the processing method was complicated.

The fact that only low concentrations of antimicrobial could be used with electret materials supports the statement in the Declaration that in the prior art, the use of an electret diminished the antimicrobial efficacy of the active agent, since only low concentrations could be used.

An attempt to incorporate an antibacterial compound into a fibrous mat was proposed in U.S. Patent No. 6,514,306, ("the '306 patent") which also taught against loading antibacterial into fiber filters that are to be used as an electret (note that iodinated resins were not disclosed). For example, the '306 patent states the following at col. 1, lines 65-67:

> For example, high loading of anti-microbial agents may interfere with certain electret fiber filter elements.

By direct contrast, Applicant's declaration, filed September 25, 2009, presents experiments that not only show that iodinated resin can be used as an antibacterial in an electret material without deleterious effects on charge stability, but also that *the charge stability was actually* ***enhanced*** *by the presence of the iodinated resin* (for example, see items #8-10 of the declaration).

3. Applicant's Declaration shows a synergy between the iodinated resin and the electret, because the use of iodinated resin with the electret not only provides biocidal properties to the media, but also *enhances* the charge stability of the electret, thereby enhancing filtration performance.

The Examiner questioned Applicant's arguments regarding synergy, arguing that the only variable is the iodinated resin. Applicant disagrees. There are two key variables – iodinated resin and dielectric carrier. There is a synergy created by the use of these two elements together, because the results are better than would be expected from the "sum total" of their combined attributes.

First of all, the use of iodinated-resin antibacterial with a charged dielectric carrier is taught against by the prior art because of the believed deleterious effect on charge posed by the iodinated resin (see arguments above). But that fact notwithstanding, if one were to take the biocidal properties of the iodinated resin and "add" those to the filtration properties of a charged dielectric carrier, the resulting combined attributes would be less than those actually seen in the experiments of the Declaration. This is because not only is the iodinated resin effective at killing

filtered microorganisms (see item #11-16 of the Declaration), but also the charge stability is actually *enhanced* by the presence of the iodinated resin (for example, see items #8-10 of the declaration) to a level greater than that without iodinated resin.

Thus, Applicant's Declaration shows a synergy between the iodinated resin and the electret, because the use of iodinated resin with the electret not only provides biocidal properties to the media, but also *enhances* the charge stability of the electret, thereby enhancing filtration performance.

4. Distinction between independent claim 1 and independent claim 25

The Examiner asked about the purpose of independent claim 25. Claim 25 has essentially the same limitations as claim 1, but recites both a first and second porous dielectric carrier. In certain embodiments, there is an air gap between the two carrier layers (e.g., see claim 27). As explained in the original Specification on page 11, lines 19-22:

> Preferably, a high dielectric constant is provided to maintain the charge for an extended period of time. For example, air provides a good dielectric constant, as can be employed in an airspace as described above. Thus, the present invention may be effective even when wet or in a humid environment.

Thus, use of multiple layers may provide enhanced performance in certain embodiments.

CONCLUSION

Based on the foregoing amendments and remarks, as well as the remarks made in Applicant's Amendment and Response filed April 9, 2010, favorable consideration and allowance of all of the claims now pending in the application are respectfully requested.

Should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, the Examiner is cordially invited to telephone the undersigned.

The Commissioner is authorized to charge any required fees, including any extension and/or excess claim fees, any additional fees, or credit any overpayment, to Goodwin Procter LLP Deposit Account No. 07-1700.

Respectfully submitted,

Date: June 8, 2010
Reg. No. 53,002

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